

SOME REMARKS ON THE FERTILIZATION OF THE
GENUS *GOODENIA*.

BY E. HAVILAND.

On perusing the Paper by Mr. Hamilton on the genus *Goodenia* read at our last Meeting, I was much surprised to find, that while admitting the correctness of my own conclusion, that *Goodenia ovata* was cross-fertilized by the aid of insects, he claims that *G. hederacea* is self-fertilised. I mentioned in my former paper on this genus (in Society's Proceedings, June 1884) that, "there could be little doubt, that the whole genus was fertilized by the aid of insects." Indeed it is difficult to imagine that plants of the same genus can differ in so important a feature as their mode of fertilization; unless it be in some partly or wholly cleistogamous plants, as in *Myrsine variabilis*; where not only in the same genus, but in the same species, one tree may be found with the whole of its flowers quite closed until self-fertilization has been effected; and yet another with a portion, only, of its flowers closed, while the remainder open in the usual way and expose themselves to cross-fertilisation; but the relative position of the organs of fertilisation is similar in both cases, and the opening or not opening in this genus I consider to be due to some mechanical condition, which, whether belonging to the individual plant, or accidental, requires investigation. Be this as it may, however; to all intents and purposes, the closed flowers, doomed to self-fertilisation, are cleistogamous, while the others are not.

Mr. Hamilton, in referring to my statement, that in *Goodenia ovata*, a mere touch will open the division of the upper lobe of the corolla, and thus admit the approach of an insect to the stigma; states his inability to open the *back* lobe of the corolla of *G. hederacea*, even with his fingers, camel hair pencil or other blunt article; unless a considerable amount of force is used. In my

paper, I speak of the *upper* lobe, and I point out, that, while the lower lobe is not divided so deeply, the upper one is divided nearly to its base. This of course makes the claws of the lobe very narrow and weak, so that the edges of the two divisions which only touch each other, are, as I said, liable to be separated by the slightest movement. Generally however, this opening of the divisions of the lobe is not necessary, the indusium and stigma being in most cases already within the corolla. I only say in my paper "*sometimes* it happens, that although the mouth of the indusium is presented to the opening of the corolla lobe, it may not have quite entered it, and that, in such case, the ready opening of the divisions of the upper lobe remedies the evil, and exposes the stigma to the visits of insects from the inside of the corolla"; but this (happening so exceptionally) is a matter of little importance. A more material point is that which Mr. Hamilton mentions as a "significant fact" that neither full anthers or empty indusia are ever found in open flowers. On reference to my paper, above referred to, it will be found that I say "Taking now a mature and *fully expanded flower*, we shall find the stamens still outside, and usually bent farther away from the corolla, the anthers all open and, and the *pollen either in abundance*, or, in some cases, past that stage, all gone, and the anthers shrivelled." Of course I intended by this to imply that the pollen was generally exposed in the open anthers, but that in some cases insects had carried it away and left the anthers empty. As to the non existence of empty indusia in open flowers. I find in my rough notes, made while studying the genus, a remark touching an open flower of *G. ovata* thus "Notwithstanding that the anthers are empty, there is not a particle of pollen either on or inside the indusium or on the stigma; showing that the flower has not been fertilised by its own pollen (for the stigma was not mature) and moreover that it has not yet received pollen from any other flower." I found many flowers in this state, but I did not deem it necessary to make a note of more than one.

Perhaps the best authority on the fertilization of plants was the late Herman Mueller, and I am bound to admit that in his work on the fertilization of flowers he agrees with Mr. Hamilton, in

supposing that the anthers in this genus deposit their pollen, in the first place, into the indusium while in the bud; but from that point he entirely differs from him. His (Herman Mueller's) opinion is pretty clearly expressed thus:—"In the plants of this order the style ends in a collecting cup which receives the pollen while still in the bud, and then closes up, leaving a narrow opening for the most part covered with hairs. At the same time it bends down to stand in the mouth of the almost horizontal flower, so that insect visitors come in contact with the hairs and dust themselves with the pollen. As the stigmatic lobes grow up in the cup (indusium) they keep forcing fresh pollen into the narrow slit, and finally emerge by it themselves and *then receive the pollen of younger flowers from insect visitors.*" My own expressed opinion, that the genus is cross-fertilised by the aid of insects, is thus corroborated by Herman Mueller, who only differs from me in supposing that the pollen is first deposited by the anthers in the indusium of the same flower, and then carried away by insects as the stigma pushes it out of the indusium. Whereas a very careful study of the genus leads me to the conclusion that insects carry away the pollen directly from the anthers, leaving in the same way the stigma when it shall have matured to receive the pollen of other flowers. Even the fact of Mr. Hamilton having found the pollen of the flower closely packed about its own stigma does not necessarily imply self-fertilisation. I have already pointed this out at length in my paper on *Utricularia*. (Pro. Lin. Soc., 29th November, 1882.) It is not by any means unusual for the stigma of a flower to be thickly covered by the pollen from its own anthers; not however for its own fertilisation, but to hold it up and expose it to the visits of insects who carry it away, leaving the stigma clean to receive other pollen in its turn. In the genus *Lobelia*, the style pushes the pollen before it out of the tube formed by the anthers, and in which it is very closely packed. This is carried away by insects; and only then do the stigmatic lobes open to receive what pollen may be brought to them. (See my paper Pro. Lin. Soc., March, 1883.) So also in the genus *Wahlenbergia*, I quote from my paper on that genus in Pro. Lin.



Soc., Dec., 1884. "When the stigma has grown far above the anthers it exposes a large mass of pollen adherent to it, it does not fall into the corolla, but is carried away (presumably) by insects for the fertilization of other flowers. Thus like *Lobelia*, in the same natural order of plants, it first offers its own pollen for the fertilization of other plants, and then exposed its own stigma to receive that of other plants in return."

But we may go still farther, and say, that even the fact of pollen tubes being emitted from the pollen grains, does not of necessity imply self-fertilization. Any one in the habit of examining the reproductive organ of plants microscopically, will frequently have found pollen tubes emitted from the pollen grains covering the stigma; and which, as the stigma is not covered by the cuticle, may even have very *slightly* penetrated it; but only to this slight extent, because the stigma is not mature or in any way prepared to utilize it. Pollen may be induced by artificial means to emit its tubes, and will do so of itself under favourable circumstances, whether on a stigma or not. As an instance of this, I may say that I had or still have a microscopic slide containing grains of pollen of the common wall-flower (*Cheiranthus chieri*) which I supposed to be quite dry when mounted, but which, from damp and warmth, emitted tubes some days afterwards. In another instance I found pollen on the stigma of *Lobelia* which had emitted tubes; but which, not being able to penetrate the unprepared surface, had raised the pollen grains so that they stood up on the face of the stigma like minute pins upon a cushion. I may perhaps add here a caution to young botanists, not to mistake this appearance on the stigma of *Wahlenbergia* for pollen grains so lifted up; the surface of that stigma being covered with globular headed glands, very likely so to mislead an inexperienced observer, into the supposition that they are pollen tubes partly penetrating the stigma.